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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,102	06/26/2003	An L. Steegan	FIS920030051	1101

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EXAMINER	
ECKERT II, GEORGE C	

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 02/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/604,102	STEEGAN ET AL.	
	Examiner	Art Unit	
	George C. Eckert II	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 December 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *27-30* is/are withdrawn from consideration.

5)☒ Claim(s) *2-5 and 15-18* is/are allowed.

6)☒ Claim(s) *1,6-14 and 19-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated December 22, 2004 in which claims 1-3, 5, 11, 14-16 and 18 were amended has been entered of record. Claims 1-30 are pending with claims 27-30 withdrawn as directed towards an invention non-elected with traverse (paper dated 8/18/04).

Claim Objections

2. Objections to claims 3, 11 and 14 have been overcome based on applicant's amendment.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 6-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over 4,888,300 to Burton in view of 6,245,636 to Maszara (both references of record). Burton teaches, with reference to figures 2-13 a method of forming an isolation structure comprising:

forming an N-doped region 14 in a substrate;

etching a vertical trench 20 in the substrate which trench extends into the N-doped region (fig. 2A);

laterally etching the N-doped region to form a lateral trench communicating with and extending perpendicular to the vertical trench (fig. 8A); and

filling the lateral and vertical trenches with an insulating material (col. 4, lines 28-35).

Burton teaches that the lateral and vertical trenches are filled with insulating undoped polysilicon rather than a material that is not a semiconductor as instantly claimed. Maszara teaches a process in figures 7 and 8 wherein lateral and vertical trenches are filled with an insulating material 80 that may comprise silicon dioxide (col. 5, lines 63-67) which is not a semiconductor material. Burton and Maszara are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the device of Burton using silicon dioxide as the trench filler material. The motivation for doing so is that silicon dioxide is merely a material substitution for the insulating polysilicon of Burton. That is, both the silicon dioxide and insulating polysilicon perform the same function of isolating a semiconductor island from its underlying substrate (e.g. island 22 of Burton isolated from its underlying substrate (col. 2, lines 20-23)). And, as taught by Maszara, the isolating material may be any electrically insulating material, for example, silicon dioxide (col. 5, lines 63-65). Therefore, it would have been obvious to combine Burton and Maszara to obtain the invention of claims 1 and 6-13.

Regarding claims 6-8, Burton teaches in figures 8A-9A the steps of partially filling the vertical and lateral trenches with a first insulating material 34 (as an insulating liner on all exposed surfaces) and completely filling the vertical and lateral trenches with a second insulating material. The use of alternative insulation materials such as TEOS and HDP oxide is considered well known in the art as mere material substitutions. Regarding claim 9, Burton teaches that an epitaxial layer may be formed on the substrate prior to forming the N-doped region (col. 3, lines 18-20). Regarding claim 10, Burton teaches that the substrate is a "P" substrate as opposed to a

"P+" substrate such that a maximum dopant concentration of 1e17 atm/cm^3 is considered inherent or obvious. Regarding claim 11, it is well known in the art that an N doped region is typically formed by either arsenic or phosphorous as both are group V materials. Regarding claim 12, Burton teaches that the horizontal and lateral trenches are etched using separate processes (col. 4, lines 7-18). Regarding claim 13, Burton teaches forming MOS devices in the substrate (col. 4, lines 48-50).

4. Claims 14 and 19-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burton in view of Maszara and 5,427,975 to Sparks et al. (all references of record). As discussed above, Burton and Maszara make obvious a process of forming a buried N+ doped region, removing the doped region to form vertical and lateral trenches and filling the trenches with an insulating, non-semiconductive material. However, neither Burton nor Maszara teach the process wherein first and second masking patterns are used.

Sparks teaches, with reference to figures 2a-c, a method of forming an N-doped region 12 and forming vertical trenches comprising two masking patterns. Sparks teaches:

forming a first patterned masking layer on a substrate 10 whereby a portion of the substrate is exposed through an opening in the first masking layer (col. 5, lines 45-68);

implanting ions into the exposed portion of the substrate to form a buried N-doped region 12 in the substrate (col. 5, lines 59-60);

removing the first masking layer (col. 5, lines 67-69) and forming a second patterned layer 16 on the substrate (col. 6, lines 22-34), an opening (generally at 20) in the second masking layer aligning over a less than whole portion of the buried N-doped region;

etching a vertical trench in the substrate through the opening in the second masking layer, the trench extending into the N-doped region (as seen in figure 2c); and

laterally etching the N-doped region to form a lateral trench communicating with and extending perpendicular to the vertical trench (see again fig. 2c).

At the time of the invention, it would have been obvious to combine Sparks with Burton and Maszara. The motivation for doing so is that Burton and Maszara merely indicate that the N-doped layer may be formed by any conventional method without providing details to do so (col. 3, lines 16-20) while Sparks provides specific steps to achieve the structure needed by Burton. As such, it is considered obvious to obtain the process of instant claims 14 and 19-26.

Allowable Subject Matter

5. Claims 2-5 and 15-18 are allowed.

Response to Arguments

6. Applicant's arguments with respect to claims 1 and 14 have been considered but are moot in view of the new grounds of rejection. Applicant argues that Burton does not teach using a solid insulating material that does not include a semiconductor material. However, the use of a material other than a semiconductor material is taught by Maszara. Specifically, Maszara teaches that silicon dioxide may be used as the material to fill the trench and thus isolate the resultant silicon island from the remaining substrate.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (571) 272-1728.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax number is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE ECKERT
PRIMARY EXAMINER